REVISED
PRELIMINARY HYDRAULIC REPORT
FOR
PASEO DE LA PLAYA
SITE 3
SANTA BARBARA, CALIFORNIA

Client: Mr. William Wright
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Date: May 16, 2007

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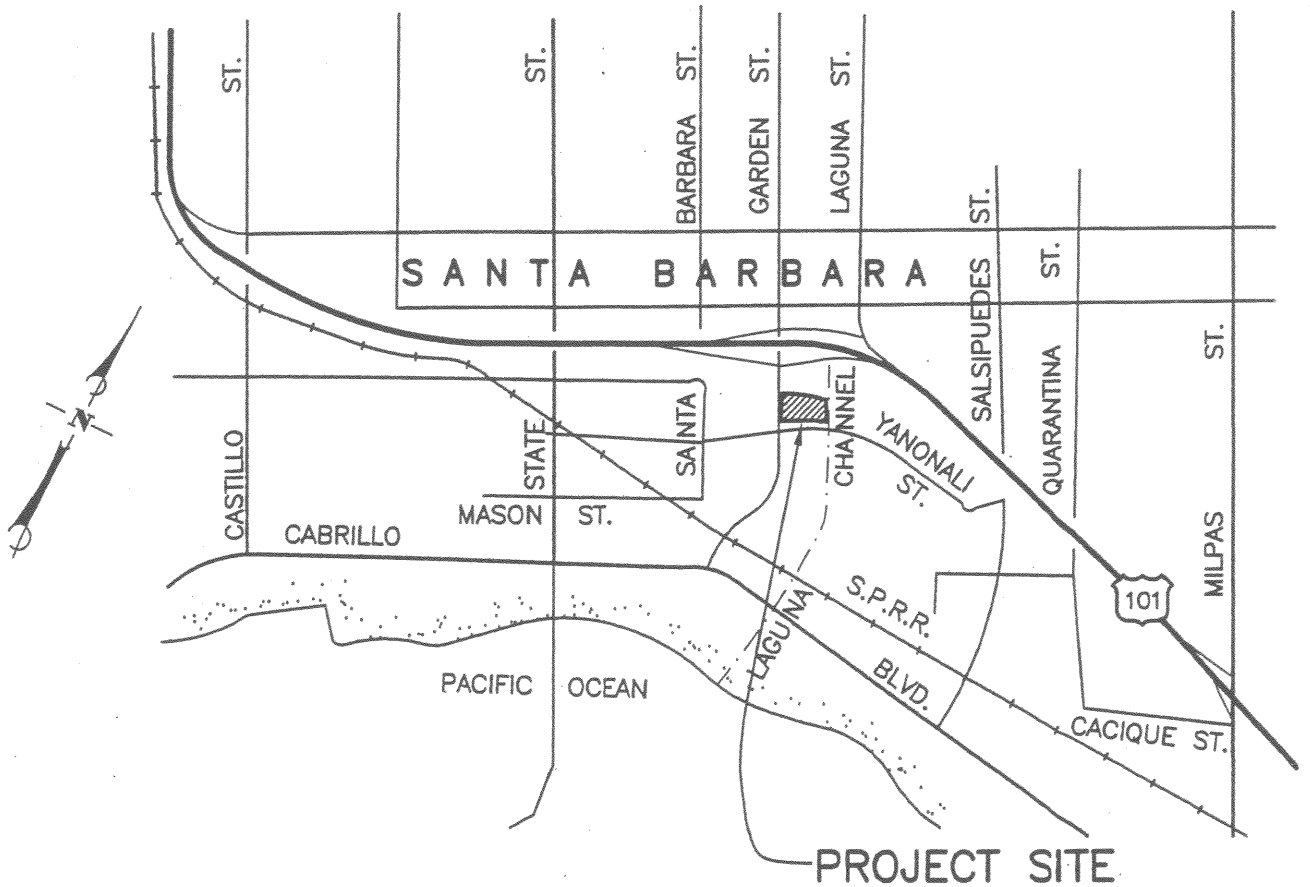
PURPOSE

The purpose of this report is to determine the runoff impacts caused by the development of a commercial project located at 301 East Yanonali Street.

PROPOSED DEVELOPMENT

The proposed project is located on a 3.01 acre site and consists of a commercial development. The property is currently occupied by buildings and impervious surfaces such as driveways. Figure 1 is a vicinity map depicting the development area.

Appendix A contains a plan delineating the pre and post-development conditions for the site.



VICINITY MAP

NO SCALE

FIGURE 1
SITE 3

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HYDROLOGY

The pre- and post- development storm water runoff was calculated using the Santa Barbara County Flood Control District (SBCFCD) Rational Method computer program for 100, 50, 25 and 10 year return period storm events. The minimum time of concentration of 12 minutes was used for all return period storm events.

Runoff coefficients for the pre- and post- development conditions were determined by calculating a weighted coefficient of runoff. The coefficient for those areas which we maintained as open space or landscaping are taken from the SBCFCD Rational Method computer program. The coefficient of runoff for all impervious areas such as roof, hardscape and paved areas will be 0.90. The factors to be used to calculate the weighted coefficient of runoff are as follows:

Return Period, yr	C, Pervious Areas	C, Impervious Areas
100	0.74	0.90
50	0.72	0.90
25	0.68	0.90
10	0.62	0.90

PRE – DEVELOPMENT RUNOFF

The area of the site is 3.01 acres and contains approximately 1.86 acres of impervious surfaces such as roofs, pavement, walkways and other hardscape. The remainder of the site, 1.15 acres, is pervious surfaces such as open space or landscaping.

The weighed coefficient of runoff for the various return period storm events is as follows:

$C_{100} = ((1.86)\ (0.90) / 3.01) + ((1.15)\ (0.74) / 3.01)$

$= (1.67 / 3.01) + (0.85 / 3.01)$

$= 0.56 + 0.28$

$C_{100} = 0.84$

$C_{50} = ((1.86)\ (0.90) / 3.01) + ((1.15)\ (0.72) / 3.01)$

$= (1.67 / 3.01) + (0.83 / 3.01)$

$= 0.56 + 0.27$

$C_{50} = 0.83$

$C_{25} = ((1.86)\ (0.90) / 3.01) + ((1.15)\ (0.68) / 3.01)$

$= (1.67 / 3.01) + (0.78 / 3.01)$

$= 0.56 + 0.26$

$C_{25} = 0.82$

$C_{10} = ((1.86)\ (0.90) / 3.01) + ((1.15)\ (0.62) / 3.01)$

$= (1.67 / 3.01) + (0.71 / 3.01)$

$= 0.56 + 0.23$

$C_{10} = 0.79$

Appendix A contains the pre-development topographic map which delineates the existing impervious areas. Appendix B contains the SBCFCD Rational Method computer printout using the weighted coefficients of runoff and a time of concentration of 12 minutes.

Hand calculations of the pre-development runoff using the rational method formula (Q = CiA) with the weighted coefficient of runoff and the SBCFCD identified rainfall intensities will allow the runoff to be calculated to the nearest tenth of a CFS. Hand calculations yield the following results.

Return Period, yr	Weighted C	Rainfall Intensity, I	Area, Acres	Q
100	0.84	4.03	3.01	10.2
50	0.83	3.68	3.01	9.2
25	0.82	3.18	3.01	7.8
10	0.79	2.61	3.01	6.2

POST – DEVELOPMENT RUNOFF

The area of the post-development site is 3.01 acres and is composed of 2.34 impervious surfaces such as roofs, pavement, walkways and other hardscape and 0.67 acres of pervious surfaces such as landscaped areas. For the purpose of this analysis, a runoff coefficient of 0.90 will be used for the post development condition.

The weighed coefficient of runoff for the various return period storm events is as follows:

C_{100} = ((2.34) (0.90) / 3.01) + ((0.67) (0.74) / 3.01)

= (2.11 / 3.01) + (0.50 / 3.01)

= 0.70 + 0.16

C_{100} = 0.86

C_{50} = ((2.34) (0.90) / 3.01) + ((0.67) (0.72) / 3.01)

= (2.11 / 3.01) + (0.48 / 3.01)

= 0.70 + 0.16

C_{50} = 0.86

C_{25} = ((2.34) (0.90) / 3.01) + ((0.67) (0.68) / 3.01)

= (2.11 / 3.01) + (0.46 / 3.01)

= 0.70 + 0.15

C_{25} = 0.85

C_{10} = ((2.34) (0.90) / 3.01) + ((0.67) (0.62) / 3.01)

= (2.11 / 3.01) + (0.42 / 3.01)

= 0.70 + 0.14

C_{10} = 0.84

Appendix A contains the post-development tributary area map which delineates the proposed impervious areas. Appendix C contains the SBCFCD Rational Method computer printout using the weighted coefficient of runoff and a time of concentration of 12 minutes.

Hand calculations of the post-development runoff using the rational method formula (Q = CiA) with the weighted coefficient of runoff and the SBCFCD identified rainfall intensities will allow the runoff to be calculated to the nearest tenth of a CFS. Hand calculations yield the following results.

Return Period, yr	Weighted C	Rainfall Intensity, I	Area, Acres	Q
100	0.86	4.03	3.01	10.4
50	0.86	3.68	3.01	9.5
25	0.85	3.18	3.01	8.1
10	0.84	2.61	3.01	6.6

PRE – VS POST – DEVELOPMENT RUNOFF

The following table is a recap of the results of the pre- and post-development runoff and indicates the change in runoff due to the proposed development.

Return Period, yr	Pre-development Runoff, cfs	Post-development Runoff, cfs	Change cfs
100	10.2	10.4	0.02
50	9.2	9.5	0.03
25	7.8	8.1	0.03
10	6.2	6.6	0.04

CONCLUSIONS

The proposed development of a commercial development will slightly increase runoff from the site, therefore pre-development runoff levels will be maintained by providing adequate retention area in the proposed vegetated swales which are being constructed as part of the development along the easterly and southerly portions of the project. The City Storm Water Management Program indicates that the following equation should be used for volumetric calculations of retention (pages E-49 and E-50):

$$V = 0.5 \times Q_{25} \text{ increase} \times 2.67 \times T_c$$

$$Q_{25} \text{ increase} = 0.03$$

$$T_c = 720 \text{ seconds}$$

$$= (0.5)\ (0.03)\ (2.67)\ (720)$$

$$V = 28.8 \text{ cf}$$

The vegetated swale proposed along the northerly portion of the site has a bottom width of 4.0 feet with a 0.001 feet per foot slope. The swales are designed to retain a 2" depth of runoff at intermediate locations within the swale and at the swale outlet (catch basin). At this location the total length of swale is approximately 700 feet. For the purpose of this preliminary report only 320 feet of the length of the swale will be assumed to retain storm water runoff. Two (2) 160' long sections of swale were selected as 160' @ 0.001 ft/ft is approximately 2" in depth. The volume available for retention is as follows:

$V = L \times D \times W$

$L = 320'$

$W = 4'$

$D = (2"/2)$

$= 1"$

$= 0.08'$

$V = (320)\ (0.08)\ (4)$

$V = 106.7$ cf

This is greater than the required volume, therefore pre-development runoff levels will be maintained.

SITE STORM DRAIN DESIGN

TRIBUTARY AREAS "A", "B" AND "C"

Tributary Area "A" contains 0.61 acres, Tributary Area "B" contains 0.56 acres and Tributary Area "C" contains 0.40 acres. All of these areas drain the roof, walk, parking areas and some landscaped areas of the site. Stormwater runoff from these areas will be conveyed to the existing 18" storm drain pipe in a 12" smooth bore HDPE storm drain pipe. This report will use Tributary Area "A" to size the storm drain pipe as it is the largest of the three tributary areas. The stormwater runoff for the 25 year return period storm event for Tributary Area "A" is as follows:

$Q_{25} = C\ i\ A$ $\qquad$ $C = 0.85$

$= (0.85)\ (3.18)\ (0.61)$ $\qquad$ $i = 3.18$ in/hr

$Q_{25} = 1.65$ cfs $\qquad$ $A = 0.61$ AC

The results of the SBCFCD full flow storm drain hydraulic computer run indicates that a ten (10) inch diameter pipe will handle the 25 year return period storm water runoff of 1.65 cfs. The following page is the computer printout from the run of the SBCFCD full flow storm drain hydraulics computer program. The project therefore will utilize a 10" HDPE smooth bore storm drain pipe to carry storm water runoff from Tributary Areas "A", "B" and "C" to the existing 18" storm drain pipe. The preliminary drainage plan contained in Appendix A delineates the proposed storm drain for the tributary areas.

Program - S T O R M D R A . E X E 05-16-2007

Project: Paseo de la Playa - Site 3 by MAC

SANTA BARBARA COUNTY FLOOD CONTROL DISTRICT FULL FLOW STORMDRAIN PIPE HYDRAULICS

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Station (ft)	Pipe Length	PipeD (in)	n	Flow (cfs)	Vel (ft/sec)	H(v) (ft)	S(f) (ft/ft)	HGL (ft)	EL (ft)
Tailwater [Downstream HGL]								0.00	
0								0.00	0.14
	50	10	0.013	1.6	3.03	0.14	0.00567		
50								0.28	0.43
End of Run @ Headwater								0.45	0.45

SANTA BARBARA COUNTY FLOOD CONTROL DISTRICT - OPEN CHANNEL FLOW HYDRAULICS

TRIBUTARY AREA "D"

Tributary Area "D" contains 1.27 acres and will drain roof, walk, parking area and some landscaped areas. Stormwater runoff from this area will flow overland to the proposed vegetated swale located along the northerly portion of the site. The project proposes a swale four (4) feet wide with 4:1 side slopes, a depth of nine (9) inches and a slope of 0.10% to carry the 25 year return period storm event from Tributary Area "D". The stormwater runoff for the 25 year return period storm event is as follows:

$Q_{25} = C\ i\ A$ $\qquad$ $C = 0.85$

$= (0.85)\ (3.18)\ (1.27)$ $\qquad$ $i = 3.18$ in/hr

$Q_{25} = 3.4$ cfs $\qquad$ $A = 1.27$ AC

The results of the SBCFCD open channel flow hydraulics computer run indicates that the proposed 4' wide drainage swale at 0.10% will carry the 25 year return period storm water runoff of 3.4 cfs. The following page is the computer printout from the run of the SCFCD open channel flow hydraulics computer program. The proposed biofilter swale will therefore be adequate to carry stormwater runoff from Tributary Area "D".

Program: C H A N N E L . B A S

Licensed to MAC Design Associates

PROJECT: Paseo de la Playa - Site 3 BY: MAC DATE: 05-16-2007

Flow in TRAPEZOIDAL Channel

Q = 3 cfs, b = 4.0 ft, z = 4.00, n = 0.025 So = 0.00100

Normal Depth	=	0.54 ft
Normal Vel	=	1.01 ft/sec
V*V/2G	=	0.02 ft
V*V/2G+Depth	=	0.56 ft
P + M	=	1 cu-ft
Froude Nr.	=	0.28
Critical Depth	=	0.26 ft

Mild Slope, 'M' Profiles
Flow is in Unstable Zone. S(O)/S(C) = 0.06
Wave Height = 0.00 ft, D(n)+Wave = 0.54 ft

BEST MANAGEMENT PRACTICE

The proposed development proposes to construct vegetated swales along the northerly property line and within the parking lot and infiltration trenches along the easterly and southerly portions of the parking lot curb. The vegetated swales will provide infiltration and biofiltration. Design criteria for these facilities will be a 1" storm drain as they will be designed as a detention basin.

APPENDIX A

PRE-DEVELOPMENT TOPOGRAPHIC MAP
AND
POST-DEVELOPMENT TRIBUTARY AREA PLAN

APPENDIX B

PRE-DEVELOPMENT RATIONAL METHOD COMPUTER PRINTOUT

Santa Barbara County Flood Control and Water Conservation District

Program Rational - XL

User Data:

Project Name:	PASEO DE LA PLAYA	**Project Number:**	0189A
Date of Run:	4/13/2006	**Run By:**	MAC
Notes:	SITE 3 PRE-DEVELOPMENT RUNOFF		

Input Data:

Location:	South Coast	Land Use Type:	Commercial
Area (Acres):	3.01	Time of Concentration (Min.):	12

	Q10:	Q25:	Q50:	Q100:
Calculated Runnoff Coefficient:	0.73	0.76	0.79	0.80
User Selected Runoff Coefficient (Optional):	0.79	0.82	0.83	0.84

Calculate

For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

Enter Selection

Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	**2.61**	**0.79**	**6**
Q25:	**3.18**	**0.82**	**8**
Q50:	**3.68**	**0.83**	**9**
Q100:	**4.03**	**0.84**	**10**

View RI Curves

View RC Curves

Print

Exit

APPENDIX C

POST-DEVELOPMENT RATIONAL METHOD COMPUTER PRINTOUT

Santa Barbara County Flood Control and Water Conservation District

Program Rational - XL

User Data:

Project Name:	PASEO DE LA PLAYA	**Project Number:**	0189A
Date of Run:	4/13/2006	**Run By:**	MAC
Notes:	SITE 3 POST-DEVELOPMENT RUNOFF		

Input Data:

Location:	South Coast	Land Use Type:	Commercial
Area (Acres):	3.01	Time of Concentration (Min.):	12

	Q10:	Q25:	Q50:	Q100:
Calculated Runnoff Coefficient:	0.73	0.76	0.79	0.80
User Selected Runoff Coefficient (Optional):	0.84	0.85	0.86	0.86

Calculate

For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

Enter Selection

Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	**2.61**	**0.84**	**7**
Q25:	**3.18**	**0.85**	**8**
Q50:	**3.68**	**0.86**	**10**
Q100:	**4.03**	**0.86**	**10**

View RI Curves

View RC Curves

Print

Exit